Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

1. (currently amended) An apparatus for determining the properties of a fluid downhole comprising:

(a) a resonator in contact with the fluid downhole, wherein the resonator electrical impedance is responsive properties of the fluid;

(b) a controller that actuates the resonator;

(c) a monitor for measuring electrical impedance of the resonator and

(d) a processor that chemometrically estimates the property of the fluid using ~~a~~ the response of the resonator to the actuation.

2. cancelled.

3. cancelled.

4. (currently amended) The apparatus of claim 1 ~~2~~, wherein the processor correlates a measured resonator response with known fluid property values.

5. (previously presented) The apparatus of claim 1, wherein the property is viscosity.

6. (previously presented) The apparatus of claim 1, wherein the property is density.

7. (previously presented) The property of claim 1, wherein the property is dielectric constant.

8. (previously presented) The apparatus of claim 1, wherein the property is resistivity.

9. (currently amended) The apparatus of claim 2, the processor applies the ~~chemometric~~ chemometrically estimated property to a Levenberg-Marquardt (LM) algorithm to determine a fluid parameter value for the fluid.

10. (currently amended) The downhole tool of claim 9 ~~10~~, wherein the fluid parameter value comprises a global minimum for the LM algorithm.

11. (currently amended) A method for determining a property of a fluid downhole the method comprising:

(a) positioning a resonator adjacent to the downhole fluid;

(b) actuating the resonator;

(c) measuring ~~a~~ the electrical impedance response of the resonator to the actuation; and

(d) chemometrically estimating a value of a property of the fluid downhole based on the measured response while the fluid is one of (i) being pumped, and (ii) static.

12. cancelled.

13. cancelled.

14. (previously presented) The method of claim 12, further comprising: correlating the response with known fluid property values.

15. (previously presented) The method of claim 11, wherein the property is viscosity.

16. (previously presented) The method of claim 11, wherein the property is density.

17. (previously presented) The method of claim 11, wherein the property is dielectric constant.

18. (previously presented) The method of claim 11, wherein the property is resistivity.

19. (currently amended) The method of claim 12, further comprising: applying the ~~chemometric~~ chemometrically estimated parameter value to a Levenberg-Marquardt (LM) algorithm to determine a fluid parameter value for the fluid.

20. (previously presented) The method of claim 19, wherein the fluid parameter value comprises a global minimum for the LM algorithm.

21-30 (cancelled)

31. (currently amended) A system for determining the properties of a downhole fluid, the system comprising:

(a) a surface controller that lowers a tool deployed in a well bore formed in an adjacent formation, the tool interacting with a down hole fluid;

(b) a resonator in contact with the downhole fluid;

(c) a controller that actuates the resonator; and

(d) a processor that estimates a value of a property for the downhole fluid using ~~a~~ an electrical impedance response of the resonator and uses a chemometric equation.

32. cancelled.

33. (currently amended) The system of claim 31 ~~32~~, wherein the processor applies a function applying the resonator response to a ~~the~~ chemometric equation to determine ~~a~~ the fluid property value.

34. (previously presented) The system of claim 31, wherein the processor uses a function for deriving a chemometric equation from measured resonator response correlated with known fluid property values.

35. (previously presented) The system of claim 31, wherein the parameter value property is viscosity.

36. (previously presented) The system of claim 31, wherein the parameter value property is density.

37. (previously presented) The system of claim 31, wherein the parameter value is dielectric constant.

38. (previously presented) The system of claim 31, wherein the parameter value property is resistivity.

39. (previously presented) The system of claim 12, wherein the processor applies the chemometric estimated parameter value property to a Levenberg-Marquardt (LM) algorithm to determine a fluid parameter value for the fluid.

40. (previously presented) The system of claim 39, wherein the fluid parameter value comprises a global minimum for the LM algorithm.

41. (previously presented) The apparatus of claim 1 wherein the resonator comprises a mechanical resonator.

42. (previously presented) The apparatus of claim 1 wherein the resonator comprises a tuning fork.

43. (currently amended) An apparatus for determining a property of a fluid downhole comprising:

(a) a resonator in direct contact with the fluid downhole;

(b) a controller that actuates the resonator; and

(c) a processor that estimates the property of the fluid using a an electrical impedance response of the resonator to the actuation and uses a chemometric equation.

44. (new) The method of claim 11 further comprising generating creating a synthetic data training set for resonator response.